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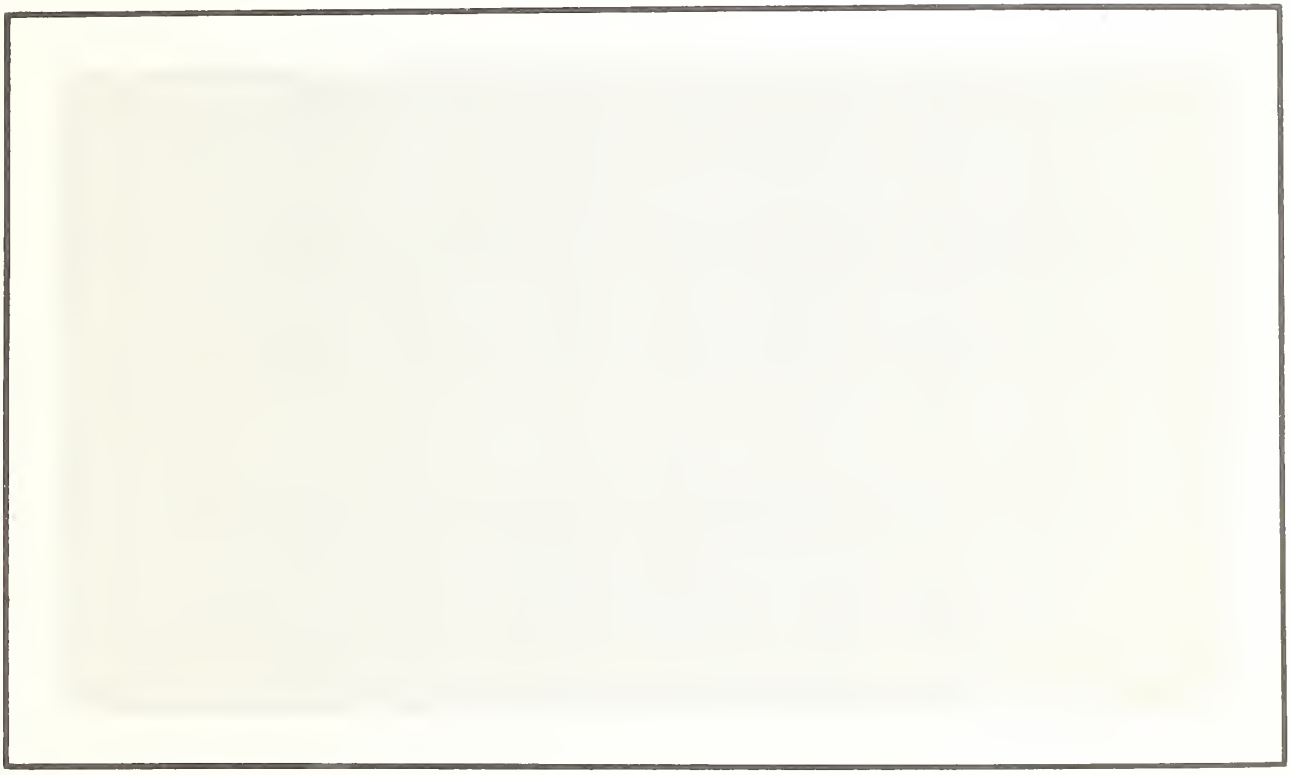
# Harvesting, Processing, and Analyzing Cotton for Byssinosis Research



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# Harvesting, Processing, and Analyzing Cotton for Byssinosis Research

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## ABSTRACT

Conducting research on the respiratory disorder known as byssinosis will require large quantities of precisely processed and analyzed cottons having various levels of contamination. This report describes the methodology used in harvesting and processing these cottons and includes analyses of the physical characteristics and properties of the lint fiber. Some of the cottons were hand-harvested in the closed-boll form, decontaminated, conditioned until the bolls opened, handpicked, ginned with minimal equipment, and protected from contamination. Other cottons were mechanically harvested and processed through a conventional ginning sequence for comparison. These cottons will be processed in a model cardroom where volunteers will be exposed to dust to determine their pulmonary function response. Index terms: byssinosis research, cotton, cotton dust, cotton-fiber properties, cotton harvesting, cotton processing.

## INTRODUCTION

Dust in lint cotton is a serious threat to the cotton industry in the United States. Cotton-related dust is suspected of causing byssinosis, a respiratory disorder, in some humans, but many years of research have failed to positively identify the causative agent. The Occupational Safety and Health Administration (OSHA) has declared cotton dust to be a health hazard and has established limits on the dust levels in some cotton-processing operations. The OSHA standard limits mean airborne concentrations of lint-free respirable dust in yarn manufacturing to 200 micrograms per cubic meter of air averaged over an 8-hour period. Dust levels in slashing and weaving processes are limited to 750 micrograms per cubic meter, and those in all other processes except ginning are limited to 500 micrograms per cubic meter. Airborne dust concentrations are determined from measurements made with a vertical elutriator or by using a method of equivalent accuracy and precision.

Although dust levels have been assumed to correlate directly with acute lung dysfunction, the correlation has not been conclusively demonstrated. It is accepted, however, that the processing of cotton in textile mills causes airway constriction in some persons. Extreme mechanical cleaning by a Shirley analyzer in addition to the normal ginning equipment

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reduced the number of airborne particles in the model cardroom at Agricultural Research Service's Cotton Quality Research Station at Clemson, S.C., by 43 percent but did not alleviate the byssinotic symptoms among exposed workers (Griffin et al. 1977). The extreme cleaning did not appreciably lower the number of particles in the respirable range (less than 15 micrometers in diameter).

Since extreme mechanical cleaning of cotton did not alleviate the effect of dust on human respiratory response, consideration was given to procuring cotton that was not contaminated with field dust and plant parts and that had not suffered weathering effects and thus would not require cleaning. Jones et al. (1976) investigated the harvesting of cotton in the closed-boll form and concluded that lint yields from such harvesting could be increased appreciably over those from the conventional harvesting of open bolls of cotton. Researchers at Agricultural Research Service's U.S. Cotton Ginning Laboratory at Stoneville, Miss., and the South Plains Ginning Research Laboratory at Lubbock, Tex., collected small quantities of closed-boll cotton in 1977 and 1978. Some of it was contaminated with bract and some was not. Conventionally harvested and processed cotton (standard cotton) was also collected as a control.

Humans were exposed to the closed-boll cotton and to the standard cotton as the cottons were processed through the model cardroom at the Cotton Quality Research Station. Boehlecke et al. (1981) reported that dust levels were significantly reduced and that the $FEV_1$ (forced expiratory volume in 1 second) response of humans was very favorable. They concluded that carding of closed-boll cottons produced significantly lower respirable dust levels than carding of standard cotton and that exposure to dust from closed-boll cotton (Stoneville, Miss.) produced smaller decrements in $FEV_1$ than standard cotton (Stoneville, Miss.). The limited quantities of closed-boll cotton available for the study prevented the researchers from achieving decisive results.

To conduct future research on byssinosis, large quantities of precisely processed and analyzed cottons having various levels of contamination will be needed. This report describes the methodology used in a study in 1979-80 to harvest and process these cottons and includes analyses of the physical characteristics and properties of the lint fiber. In future investigations, these cottons will be processed in a model cardroom where volunteers will be exposed to dust to determine their pulmonary function response.

## PROCEDURES

The cottons and the amount of lint obtained from each were as follows:

Cotton 1—2,679 pounds of lint from cotton hand-harvested in the closed-boll form with the bract, calyx, and stem removed.

Cotton 2—2,671 pounds of lint from cotton hand-harvested in the closed-boll form with bract, calyx, and stem intact.

Cotton 3—2,928 pounds of lint from cotton (control) harvested with a spindle picker and processed through a conventional ginning sequence.

Cotton 4—596 pounds of lint from cotton hand-harvested in the field from fully opened bolls.

Cotton 5—607 pounds of lint from spindle-harvested cotton that had received minimum exposure to the weather.

Cotton 6—8,199 pounds of lint from additional cotton processed similarly to cotton 3.

### Cottons 1, 2, and 3

A 38-acre field of 'Deltapine 55' variety of cotton was purchased from a local farmer for this study. The field, a Dundee silt loam soil, had been continuously planted to cotton for the past 50 years, and conventional production practices had been used for the total acreage. We divided the field into two fields—one 24 acres and the other 14 acres. Test cottons 1 and 2 were harvested from the larger field and cotton 3 from the smaller field.

The closed-boll cotton was collected in several phases that were synchronized from a time and manpower standpoint. Hand-harvesting of closed bolls for cotton 1 began on September 4, 1979 and continued through October 5, 1979. Cotton 2 (closed bolls with bract, stem, and

calyx intact) was harvested from October 10 through October 24, 1979. In total, we hand-harvested 144,610 pounds of closed green bolls—82,614 pounds of cotton 1 and 61,996 pounds of cotton 2. The hand-harvesting procedure required the daily use of 45 hand laborers for 27 days. The seed cotton for cotton 3 was spindle-harvested from open bolls in the 14-acre field on October 25, 1979.

Personnel of the U.S. Cotton Ginning Laboratory collected the containers of bolls in the fields and transported them to the Laboratory at Stoneville. The bolls of cotton 1 were inspected individually, and the damaged bolls were discarded. Any remaining bracts on the undamaged bolls were removed by hand. An inspection was not made of cotton 2. The bolls of cottons 1 and 2 were then decontaminated by soaking for 10 minutes in a solution of 0.5-percent sodium hypochlorite. Six washing containers, with a capacity of 80 pounds each, were used (fig. 1). After decontamination the bolls were placed on 4- by 8-foot wire-bottom conditioning trays, and the surface moisture was allowed to evaporate. About 120 pounds of closed bolls were placed on each conditioning tray. The bolls were stored inside the building (fig. 2) and conditioned for about 5 days under climatic conditions of 95° F and 30 percent RH. After 5 days, the bolls were hand-separated into three categories—well-opened, moderately opened, and unopened.

The bolls that remained unopened after 5 days were discarded, and the other categories of bolls were processed separately to maintain segregation by estimated fiber maturity. The bractless seed cotton (cotton 1) was removed from the open carpel by hand and was then processed through one 20-saw gin stand, packaged in polyethylene bags, and sealed. The bract cotton (cotton 2) was mechanically separated from the carpel and cleaned with a stick machine, extractor feeder, and lint cleaner. Cotton 2 was ginned on the same 20-saw gin.

Seed cotton from cottons 1 and 2 was subdivided into 55 and 20 batches of various sizes, respectively, for convenience in sampling and processing. After the seed were removed from the seed cotton, 2,679 and 2,671 pounds of lint remained for cottons 1 and 2, respectively. The characteristics of the cotton were monitored for each of the 75 batches. Data obtained from small batches were weighted equally with those obtained from large batches.

Identity of the bolls harvested on each particular day was maintained from the time of harvest until the list was packaged in polyethylene bags. Samples for moisture determination and for seed and fiber properties were taken as the cotton was processed. Fiber and seed properties were used initially to assess lint maturity, which correlates directly with micronaire as well as with several of the seed properties. Micronaire was used as the expedient estimate of maturity because this measurement requires less than 1 minute to obtain. Seed-cotton moisture, lint moisture, and micronaire were determined immediately after

FIGURE 1.—Closed bolls in the decontaminating stage.

FIGURE 2.—Closed bolls from cotton 1 stored on conditioning trays (conditioned 5 days).

ginning. Caution was exercised throughout the various processing stages to avoid contamination of the cotton. Samples were also analyzed for 2.5-percent span length, 50-percent span length, uniformity ratio, strength (⅛-inch gage), and lint foreign-matter content (Shirley analyzer). Noncellulosic constituents such as sugar, wax, alcohol extractables, and oils were identified. The following properties of the cottonseed were evaluated to characterize the seed: (1) foreign matter, (2) free fatty acids, (3) oil, (4) ammonia, (5) quality index, (6) quantity index, (7) grade, (8) estimated yield, and (9) germination. Fiber analyses, with the exception of micronaire and grade, were determined at the Cotton Quality Research Station. Fiber length and uniformity were measured with a digital fibrograph.

**Table 1.—Harvest dates and quantities for cottons 1, 2, and 3**

| Cotton number | 1979 harvest date | | Quantity harvested (lb) | |
|---|---|---|---|---|
| | | | Bolls[1] | Seed cotton[2] |
| 1 | Sept. | 4 | 2,616 | ..... |
| | | 5 | 3,606 | 54.2 |
| | | 6 | 4,082 | 35.2 |
| | | 7 | 3,929 | 47.8 |
| | | 10 | 3,817 | 329.8 |
| | | 11 | 6,953 | 382.3 |
| | | 12 | 4,547 | 353.7 |
| | | 18 | 2,654 | 215.2 |
| | | 19 | 5,439 | 455.3 |
| | | 24 | 4,966 | 373.9 |
| | | 25 | 5,040 | 493.2 |
| | | 26 | 4,944 | 363.7 |
| | | 27 | 4,988 | 489.3 |
| | | 28 | 4,135 | 442.0 |
| 1 | Oct. | 1 | 3,473 | 374.0 |
| | | 2 | 4,323 | 419.0 |
| | | 3 | 4,500 | 456.3 |
| | | 4 | 4,556 | 468.5 |
| | | 5 | 4,041 | 287.5 |
| 2 | Oct. | 10 | 6,965 | 941.0 |
| | | 11 | 10,533 | 1,833.3 |
| | | 12 | 3,443 | 444.4 |
| | | 16 | 8,382 | 1,347.6 |
| | | 17 | 8,347 | 1,714.9 |
| | | 18 | 2,570 | 444.7 |
| | | 23 | 9,215 | 1,352.6 |
| | | 24 | 12,240 | 1,954.1 |
| 3 | Oct. | 24 | (3) | 9,080.0 |

[1]Moisture content was 70 to 85 pct, wet basis.

[2]Moisture content of lint immediately after ginning was about 5 pct, wet basis.

[3]Spindle-harvested from open bolls.

The various batches of lint cotton were combined into bales within cottons 1 and 2 according to micronaire range—3.50 to 4.50, 3.00 to 3.49, 2.50 to 2.99, or <2.3 to 2.49. The bales were then compressed and packaged in double bags of 8-mil polyethylene and sealed. The control cotton, cotton 3, was processed through a conventional ginning sequence consisting of feed control, two tower driers (150° F), three seed-cotton cleaners, extractor feeder, gin stand, and two lint cleaners. The bales were then packaged and sealed in double 8-mil polyethylene bags.

### Cottons 4, 5, and 6

About 1,500 pounds of seed cotton were hand-harvested for cotton 4 from open bolls of cotton in the 14-acre field and processed through an extractor feeder and a gin stand. About 1,700 pounds of seed cotton were machine-harvested for cotton 5 from the same rows in the 14-acre field as was cotton 4. The cotton had opened in the 5-day period after the open-boll cotton was hand-harvested. Cotton 5 was not exposed to rainfall or adverse weather while it was open in the field. It was processed in the gin with the same equipment as cotton 3. An additional 17 bales of cotton (cotton 6) were machine-harvested from both fields in order to provide additional control bales as well as bales for a proposed experiment with washed cotton (Perkins 1981). Cotton 6 was processed with the same equipment as cotton 3.

Figure 3.—Closed bolls from cotton 1 after 1 day of conditioning.

## RESULTS

### Cottons 1, 2, and 3

Closed bolls were harvested, decontaminated, and processed as described previously in this report. Harvest dates and quantities are shown in table 1. Representative bolls after 1, 3, and 5 days of storage are shown in figures 3, 4, and 5, respectively. The bolls opened slowly, but once they were slightly open the drying rate increased substantially. Separation of the conditioned bolls into three categories was based on the appearance of the bolls, as shown in figure 6. The percentage of bolls in each category was not monitored daily; however, representative values for cotton 2 are illustrated in table 2. The daily percentages of bolls in each category fluctuated widely.

Figure 4.—Partially opened bolls from cotton 1 after 3 days of conditioning.

Figure 5.—Bolls from cotton 1 after 5 days of conditioning.

### Fiber properties

Fiber properties for individual batches of cotton are given for cotton 1 in tables 3 and 4. Tables 5 and 6 contain similar data for cotton 2. Fiber data for the control cotton, cotton 3, are given in tables 7 and 8. Means and standard deviations for the fiber properties of cottons 1, 2, and 3 are given in table 9. The mean for the 2.5-percent span length of cotton 1 (1.20 inches) was higher than that for cottons 2 or 3 (1.14 inches). Means for the 50-percent span length and uniformity ratio were also higher for cotton 1 than those for cotton 2. Standard deviations for

(*Continued on page 11.*)

**Table 2.—Representative distribution of bolls from cotton 2 by degree of opening after 5 days of conditioning**

| Harvest date | Percentage of bolls in each category | | |
|---|---|---|---|
| | Well-opened | Moderately opened | Unopened |
| Oct. 10 | 29 | 19 | 52 |
| 11 | 31 | 23 | 46 |
| 12 | 47 | 15 | 39 |
| 17 | 49 | 30 | 21 |
| 24 | 34 | 25 | 41 |
| Mean | 38 | 22 | 40 |

Figure 6.—Typical bolls in the well-opened (left), moderately opened (middle), and unopened or discard (right) categories.

**Table 3.—Results of tests on cotton 1 for fibrograph length and length uniformity, Pressley strength, micronaire fineness, and classer's staple length[1]**

| Bale number | Batch number | Digital fibrograph | | | Pressley strength, ⅛-inch gage (g/tex) | Micronaire reading | Classer's staple length (32d inch) |
|---|---|---|---|---|---|---|---|
| | | 2.5-pct span length (inches) | 50-pct span length (inch) | Uniformity ratio (pct) | | | |
| 4022 | 1 | 1.18 | 0.47 | 39.0 | 27.3 | 2.5 | 36 |
| | 3 | 1.18 | .48 | 41.0 | 26.8 | 2.9 | 36 |
| | 4 | 1.17 | .47 | 40.0 | 27.1 | 2.6 | 35 |
| | 9 | 1.19 | .52 | 44.0 | 27.1 | 2.4 | 35 |
| | 13 | 1.18 | .51 | 43.0 | 27.2 | 2.8 | 36 |
| | 15 | 1.22 | .53 | 43.0 | 26.1 | 3.6 | 36 |
| | 20 | 1.22 | .53 | 44.0 | 26.4 | 3.8 | 36 |
| | 23 | 1.25 | .55 | 44.0 | 27.4 | 4.1 | 36 |
| | 25 | 1.20 | .52 | 43.0 | 26.2 | 3.6 | 36 |
| | 37 | 1.18 | .49 | 42.0 | 26.2 | 2.9 | 36 |
| | 51 | 1.17 | .48 | 41.0 | 27.3 | 2.9 | 35 |
| | 54 | 1.17 | .47 | 40.0 | 26.8 | 2.8 | 36 |
| 4023 | 2 | 1.18 | .49 | 41.0 | 26.8 | 3.0 | 36 |
| | 10 | 1.23 | .55 | 45.0 | 27.6 | 3.3 | 36 |
| | 11 | 1.20 | .51 | 43.0 | 26.5 | 3.0 | 36 |
| | 18 | 1.21 | .53 | 44.0 | 28.5 | 3.6 | 36 |
| | 28 | 1.18 | .48 | 40.0 | 26.8 | 3.2 | 36 |
| | 29 | 1.20 | .52 | 43.0 | 27.1 | 3.4 | 36 |
| | 31 | 1.18 | .55 | 46.0 | 26.9 | 3.1 | 35 |
| | 33 | 1.21 | .51 | 42.0 | 27.4 | 3.1 | 35 |
| 4024 | 35 | 1.23 | .54 | 44.0 | 25.7 | 3.2 | 35 |
| | 39 | 1.20 | .53 | 44.0 | 23.7 | 3.2 | 35 |
| | 41 | 1.20 | .55 | 46.0 | 25.5 | 3.2 | 35 |
| | 43 | 1.21 | .54 | 44.0 | 25.2 | 3.2 | 35 |
| | 47 | 1.21 | .52 | 43.0 | 25.9 | 3.4 | 35 |
| | 49 | 1.20 | .50 | 42.0 | 25.6 | 3.0 | 35 |
| | 53 | 1.15 | .48 | 42.0 | 25.7 | 3.0 | 34 |
| 4025 | 6 | 1.22 | .55 | 45.0 | 25.9 | 4.5 | 35 |
| | 12 | 1.24 | .55 | 45.0 | 25.3 | 3.6 | 36 |
| | 14 | 1.19 | .52 | 43.0 | 25.4 | 4.1 | 35 |
| | 16 | 1.23 | .55 | 45.0 | 25.8 | 4.0 | 35 |
| | 17 | 1.17 | .48 | 41.0 | 25.2 | 3.7 | 35 |
| | 19 | 1.23 | .55 | 45.0 | 24.8 | 2.9 | 35 |
| | 21 | 1.22 | .55 | 46.0 | 25.6 | 3.6 | 36 |
| | 22 | 1.20 | .55 | 46.0 | 26.5 | 2.9 | 35 |
| | 24 | 1.22 | .56 | 45.0 | 25.4 | 3.6 | 35 |
| | 26 | 1.21 | .54 | 45.0 | 25.0 | 4.1 | 35 |
| | 27 | 1.21 | .54 | 44.0 | 25.5 | 4.1 | 36 |
| 4026 | 30 | 1.20 | .55 | 46.0 | 25.3 | 4.3 | 35 |
| | 32 | 1.20 | .54 | 45.0 | 24.6 | 4.0 | 35 |
| | 34 | 1.24 | .58 | 47.0 | 25.6 | 3.8 | 35 |
| | 36 | 1.21 | .55 | 46.0 | 25.2 | 3.8 | 36 |
| | 38 | 1.20 | .55 | 46.0 | 24.1 | 3.9 | 36 |
| | 40 | 1.20 | .56 | 47.0 | 25.1 | 4.0 | 36 |
| | 42 | 1.22 | .54 | 44.0 | 26.0 | 4.3 | 36 |
| | 44 | 1.25 | .58 | 46.0 | 24.3 | 4.3 | 36 |
| 4027 | 45 | 1.21 | .54 | 45.0 | 25.4 | 3.6 | 36 |
| | 46 | 1.20 | .52 | 44.0 | 24.3 | 3.9 | 35 |
| | 48 | 1.23 | .56 | 46.0 | 24.3 | 3.8 | 36 |
| | 50 | 1.22 | .56 | 46.0 | 25.4 | 4.1 | 35 |
| | 52 | 1.16 | .51 | 44.0 | 25.6 | 4.1 | 35 |
| | 55 | 1.20 | .54 | 45.0 | 24.5 | 3.9 | 36 |

[1]All grades for bales 4022–4027 were grade 11 (Good Middling). Samples would have graded Strict Good Middling (grade 01), except standard was discontinued in 1975.

**Table 4.—Results of tests on cotton 1 for hydrocarbon oil contamination and reflectance and yellowness of lint[1]**

| Bale number | Batch number | Hydrocarbon oil contamination[2] (pct) | Colorimeter code[3] | |
|---|---|---|---|---|
| | | | $R_d$ | $+b$ |
| 4022 | 1 | 0.15 | NM | NM |
| | 3 | .17 | NM | NM |
| | 4 | .20 | NM | NM |
| | 9 | .17 | 84.0 | 10.8 |
| | 13 | .16 | NM | NM |
| | 15 | .17 | NM | NM |
| | 20 | .17 | NM | NM |
| | 23 | .18 | NM | NM |
| | 25 | .17 | 84.0 | 10.8 |
| | 37 | .16 | NM | NM |
| | 51 | .14 | NM | NM |
| | 54 | .15 | NM | NM |
| 4023 | 2 | .20 | NM | NM |
| | 10 | .16 | NM | NM |
| | 11 | .17 | NM | NM |
| | 18 | .19 | 81.9 | 10.8 |
| | 28 | .16 | NM | NM |
| | 29 | .14 | NM | NM |
| | 31 | .17 | 82.0 | 10.8 |
| | 33 | .17 | NM | NM |
| 4024 | 35 | .13 | NM | NM |
| | 39 | .14 | 83.2 | 10.4 |
| | 41 | .20 | NM | NM |
| | 43 | .14 | NM | NM |
| | 47 | .19 | 83.4 | 10.2 |
| | 49 | .17 | NM | NM |
| | 53 | .15 | NM | NM |
| 4025 | 6 | 0.08 | NM | NM |
| | 12 | .14 | NM | NM |
| | 14 | .14 | NM | NM |
| | 16 | .14 | 82.6 | 9.8 |
| | 17 | .13 | NM | NM |
| | 19 | .11 | NM | NM |
| | 21 | .13 | NM | NM |
| | 22 | .12 | NM | NM |
| | 24 | .13 | 81.6 | 9.5 |
| | 26 | .09 | NM | NM |
| | 27 | .12 | NM | NM |
| 4026 | 30 | .11 | NM | NM |
| | 32 | .14 | NM | NM |
| | 34 | .10 | 83.0 | 10.2 |
| | 36 | .17 | NM | NM |
| | 38 | .10 | NM | NM |
| | 40 | .11 | NM | NM |
| | 42 | .15 | 82.8 | 9.9 |
| | 44 | .13 | NM | NM |
| 4027 | 45 | .12 | NM | NM |
| | 46 | .14 | 81.6 | 9.5 |
| | 48 | .12 | NM | NM |
| | 50 | .13 | NM | NM |
| | 52 | .13 | NM | NM |
| | 55 | .16 | 82.1 | 9.4 |

[1]Sugar content was above 0.35 pct for all batches in cotton 1.
[2]Values less than 0.30 pct are considered normal, since the natural oils may account for that amount.
[3]NM=not measured.

**Table 5.—Results of tests on cotton 2 for fibrograph length and length uniformity, Pressley strength, classer's staple length, and AMS grade index**

| Bale number | Batch number | Digital fibrograph | | | Pressley strength, 1/8-inch gage (g/tex) | Classer's staple length (32d inch) | AMS grade index[1] | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2.5-pct span length (inches) | 50-pct span length (inch) | Uniformity ratio (pct) | | | Color | Leaf | Composite |
| 4033 | 56 | 1.19 | 0.50 | 42.1 | 24.4 | 36 | 31 | 41 | 40 |
| | 58 | 1.19 | .50 | 41.7 | 24.2 | 36 | 31 | 41 | 40 |
| 4034 | 60 | 1.20 | .51 | 42.0 | 23.8 | 36 | 31 | 51 | 41 |
| | 63 | 1.18 | .50 | 41.8 | 23.5 | 35 | 31 | 41 | 40 |
| 4035 | 64 | 1.16 | .48 | 41.2 | 24.4 | 36 | 31 | 41 | 40 |
| | 68 | 1.17 | .48 | 41.3 | 24.6 | 36 | 31 | 41 | 41 |
| | 71 | 1.17 | .47 | 40.2 | 23.9 | 36 | 31 | 51 | 41 |
| 4036 | 61 | 1.13 | .46 | 40.7 | 24.6 | 34 | 31 | 51 | 41 |
| | 65 | 1.10 | .43 | 39.0 | 24.1 | 34 | 31 | 41 | 40 |
| | 67 | 1.11 | .46 | 40.5 | 26.0 | 35 | 31 | 41 | 41 |
| | 72 | 1.12 | .45 | 39.5 | 24.8 | 34 | 31 | 41 | 40 |
| 4037 | 57 | 1.13 | .46 | 40.4 | 24.8 | 35 | 31 | 51 | 41 |
| | 59 | 1.15 | .47 | 40.5 | 24.2 | 36 | 41 | 51 | 50 |
| | 70 | 1.14 | .45 | 40.0 | 24.2 | 36 | 31 | 41 | 40 |
| 4038 | 62 | 1.13 | .44 | 39.0 | 24.9 | 35 | 41 | 41 | 41 |
| | 66 | 1.12 | .44 | 39.7 | 24.9 | 35 | 31 | 41 | 40 |
| | 73 | 1.10 | .41 | 38.2 | 26.0 | 34 | 31 | 51 | 41 |
| | 74 | 1.12 | .44 | 39.7 | 25.9 | 34 | 41 | 51 | 50 |
| | 75 | 1.09 | .42 | 38.4 | 25.7 | 34 | 31 | 41 | 40 |

[1]Agricultural Marketing Service (AMS) grades are defined as follows: 31=Middling, 40=Strict Low Middling Plus, 41=Strict Low Middling, 50=Low Middling Plus, and 51=Low Middling.

**Table 6.—Results of tests on cotton 2 for foreign-matter content, hydrocarbon oil contamination, micronaire fineness, and reflectance and yellowness of lint[1]**

| Bale number | Batch number | Lint foreign matter (pct) | Hydrocarbon oil contamination[2] (pct) | Micronaire reading | Colorimeter code | |
|---|---|---|---|---|---|---|
| | | | | | $R_d$ | $+b$ |
| 4033 | 56 | 3.96 | 0.14 | 4.2 | 81.2 | 9.4 |
| | 58 | 2.42 | .12 | 3.8 | 81.9 | 9.4 |
| 4034 | 60 | 3.27 | .17 | 4.2 | 80.6 | 9.0 |
| | 63 | 4.87 | .17 | 3.5 | 80.8 | 9.4 |
| 4035 | 64 | 3.50 | .18 | 3.3 | 80.4 | 9.5 |
| | 68 | 3.68 | .17 | 3.5 | 80.9 | 9.0 |
| | 71 | 4.18 | .17 | 3.0 | 81.0 | 8.7 |
| 4036 | 61 | 4.70 | .18 | 2.7 | 79.9 | 10.3 |
| | 65 | 5.59 | .20 | 2.5 | 80.5 | 10.0 |
| | 67 | [3] | .18 | 2.5 | [3] | [3] |
| | 72 | 3.59 | .16 | 2.9 | 81.6 | 9.4 |
| 4037 | 57 | 5.09 | .18 | 2.7 | 78.9 | 10.8 |
| | 59 | 5.70 | .17 | 2.8 | 78.1 | 10.1 |
| | 70 | 4.01 | .17 | 2.8 | 80.9 | 9.0 |
| 4038 | 62 | [3] | .21 | 2.4 | 79.9 | 10.5 |
| | 66 | 5.00 | .21 | 2.4 | 80.5 | 9.8 |
| | 73 | 6.33 | .21 | <2.3 | 81.6 | 9.4 |
| | 74 | 6.78 | .21 | 2.4 | 80.2 | 9.0 |
| | 75 | 5.91 | .21 | 2.3 | 81.1 | 9.5 |

[1]Sugar content was above 0.35 pct for all batches in cotton 2.

[2]Values less than 0.30 pct are considered normal, since the natural oils may account for that amount.

[3]Data not available.

**Table 7.—Results of tests on cotton 3 for fibrograph length and length uniformity, Pressley strength, AMS grade index, and classer's staple length**

| Bale number | Digital fibrograph | | | Pressley strength, 1/8-inch gage (g/tex) | AMS grade index[1] | | | Classer's staple length (32d inch) |
|---|---|---|---|---|---|---|---|---|
| | 2.5-pct span length (inches) | 50-pct span length (inch) | Uniformity ratio (pct) | | Color | Leaf | Composite | |
| 4001 | 1.11 | 0.45 | 41.2 | 24.0 | 31 | 41 | 40 | 35 |
| 4002 | 1.15 | .47 | 41.4 | 24.1 | 31 | 41 | 40 | 35 |
| 4003 | 1.14 | .47 | 40.8 | 24.1 | 31 | 41 | 40 | 35 |
| 4004 | 1.14 | .46 | 41.0 | 24.2 | 31 | 41 | 40 | 35 |
| 4005 | 1.13 | .47 | 41.4 | 23.6 | 31 | 41 | 40 | 35 |
| 4006 | 1.14 | .47 | 41.2 | 23.7 | 31 | 41 | 40 | 35 |

[1]Agricultural Marketing Service (AMS) grades are defined as follows: 21=Strict Middling, 31=Middling, 40=Strict Low Middling Plus, 41=Strict Low Middling, 42=Strict Low Middling Light Spotted, and 51=Low Middling.

**Table 8.—Results of tests on cotton 3 for hydrocarbon oil contamination and reflectance and yellowness of lint[1]**

| Bale number | Hydrocarbon oil contamination[2] (pct) | Colorimeter code | |
|---|---|---|---|
| | | $R_d$ | $+b$ |
| 4001 | 0.27 | 78.3 | 8.6 |
| 4002 | .15 | 78.0 | 8.8 |
| 4003 | .14 | 78.0 | 8.8 |
| 4004 | .16 | 78.0 | 8.8 |
| 4005 | .14 | 79.0 | 8.8 |
| 4006 | .14 | 79.1 | 8.8 |

[1]Sugar content was above 0.35 pct for all batches in cotton 3.

[2]Values less than 0.30 pct are considered normal, since the natural oils may account for that amount.

**Table 9.—Means and standard deviations for fiber properties of cottons 1, 2, and 3[1]**

| Cotton number | Statistic | Digital fibrograph | | | Pressley strength, ⅛-inch gage (g/tex) | AMS grade index[2] | | | AMS staple length (32d inch) | Hydrocarbon oil contamination[3] (pct) | Colorimeter code | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2.5-pct span length (inches) | 50-pct span length (inch) | Uniformity ratio (pct) | | Color | Leaf | Composite | | | $R_d$ | $+b$ |
| 1 | Mean | 1.20 | 0.53 | 43.80 | 25.90 | 11 | 11 | 11 | 35.50 | 0.15 | 82.68 | 10.12 |
| | Standard deviation | .02 | .03 | 2.00 | 1.00 | ..... | ..... | ..... | .50 | .03 | .86 | .54 |
| 2 | Mean | 1.14 | .46 | 40.30 | 24.70 | 31 | 41 | 40 | 35.10 | .18 | 80.56 | 9.57 |
| | Standard deviation | .03 | .03 | 1.20 | .80 | ..... | ..... | ..... | .90 | .02 | .94 | .58 |
| 3 | Mean | 1.14 | .47 | 41.20 | 24.00 | 31 | 41 | 40 | 35.00 | .17 | 78.40 | 8.77 |
| | Standard deviation | .01 | .01 | .23 | .24 | ..... | ..... | ..... | .00 | .05 | .52 | .08 |

[1]Sugar content was greater than 0.35 pct for all 3 cottons.

[2]Agricultural Marketing Service (AMS) grades are defined as follows: 11=Good Middling, 31=Middling, 40=Strict Low Middling Plus, and 41=Strict Low Middling.

[3]Values lower than 0.30 pct are considered normal, since the natural oils may account for that amount.

2.5-percent span length and 50-percent span length were about equal. However, the standard deviations for uniformity ratio were much larger for cottons 1 and 2 than for cotton 3. The higher deviations in the closed-boll cottons were primarily due to differences between the maturity of the bolls in cottons 1 and 2 and that of the bolls in cotton 3, which, as previously discussed, is evidenced by the differences in micronaire. Pressley ⅛-inch-gage strength was 25.90, 24.70 and 24.00 grams per tex, respectively, for cottons 1, 2, and 3. Standard deviations were larger for cottons 1 and 2 than for cotton 3.

Agricultural Marketing Service (AMS) grade index for cotton 1 was Good Middling for color and leaf. The cotton contained no visible foreign matter. Color and leaf grades were the same for cottons 2 and 3. Cotton 2 contained bract and shale (carpel wall) as foreign matter, whereas cotton 3 contained typical field trash. Cotton 3 had also suffered weathering effects. Staple length was greater for cotton 1 (1.11 inches) than for cotton 2 (1.10 inches) or cotton 3 (1.09 inches).

Hydrocarbon oil contamination was considered normal for all cottons, since the measured values were all less than 0.18 percent. (Natural oils may represent as much as 0.30 of a percentage point.) Sugar content was greater than 0.35 percent for all three cottons.

Reflectance ($R_d$) was higher for cotton 1 (82.68) than for cotton 2 (80.56) or cotton 3 (78.40). Cottons 1 and 2 had a visible luster that was not present in cotton 3.

The weighted micronaire reading as a function of harvest day for cottons 1 and 2 (fig. 7) started at 2.6 on day 1, peaked at 3.7 on day 29, and then declined steadily to 2.7 on day 52. The trend of the rise and fall of the micronaire readings was generally the same as might be expected for normally harvested cotton. Micronaire readings correlated with the manual separations of the bolls into the well-opened and moderately opened categories. Figure 8 is a plot of the micronaire readings for the cotton processed from well-opened and moderately opened bolls (cottons 1 and 2). Extreme deviation in the micronaire readings was primarily a result of the different areas of harvest within the field and, thus, the maturity of the bolls.

Previous research indicated that about 16 pounds of mature, closed bolls were required to yield about 1 pound of lint cotton. In this study, however, separation of the conditioned bolls

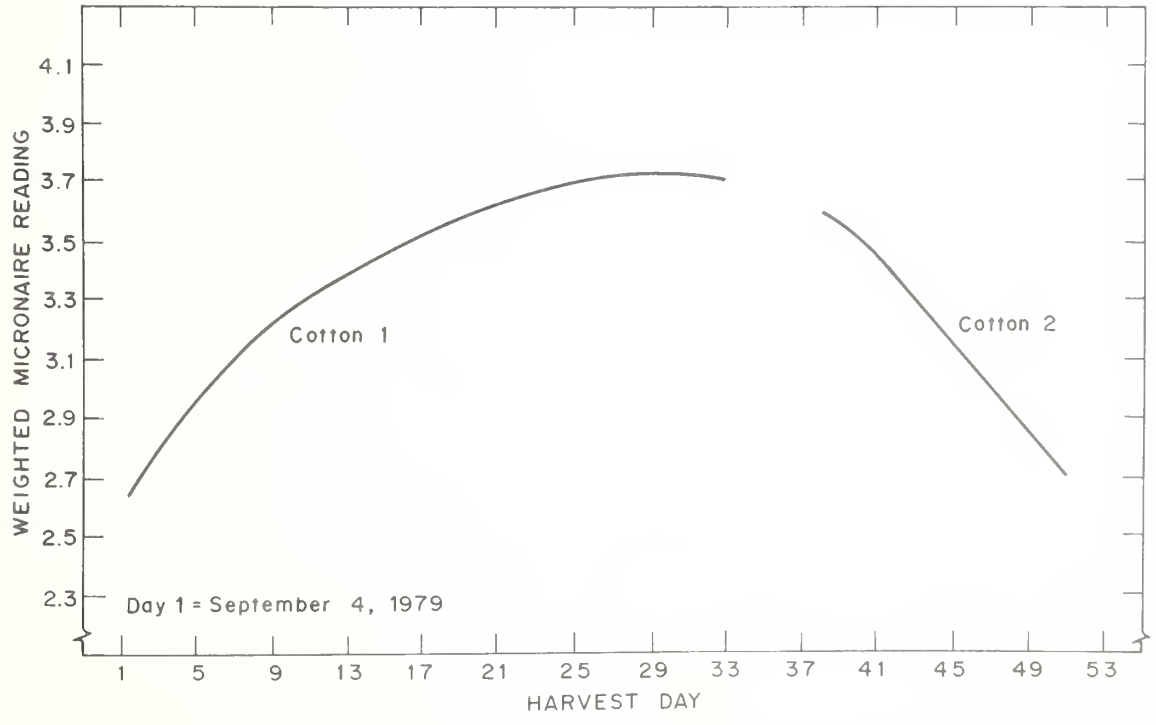


FIGURE 7.—Weighted micronaire as a function of harvest day for cottons 1 and 2.

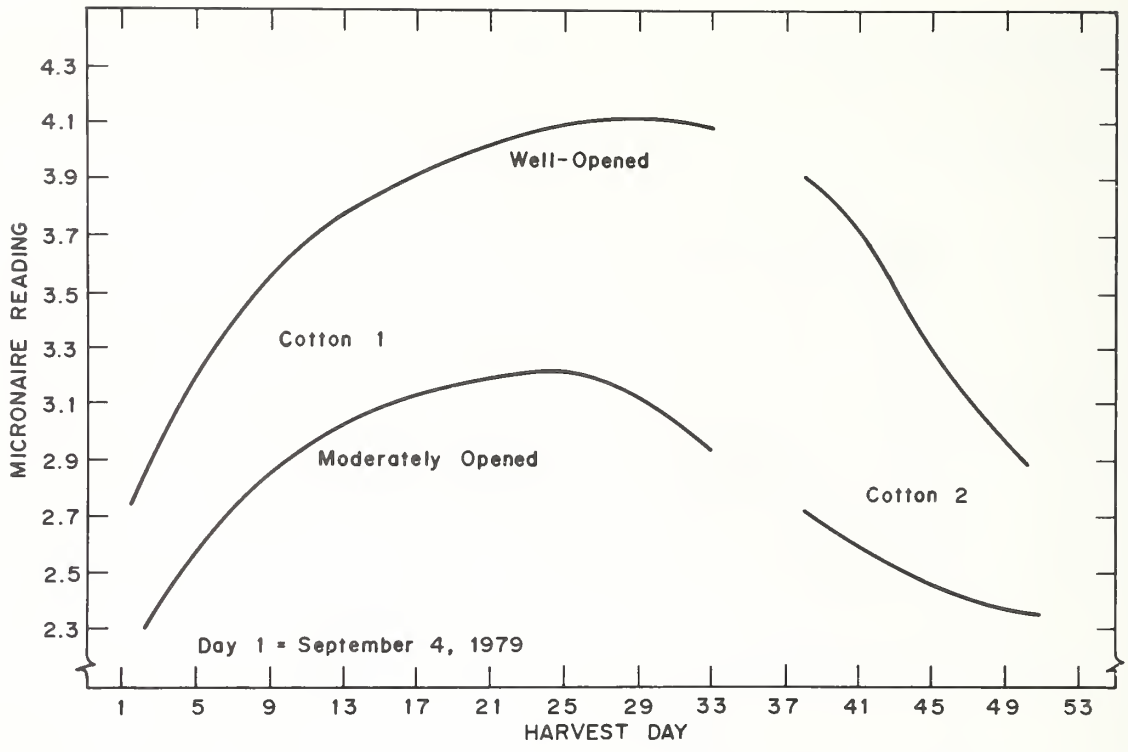


FIGURE 8.—Micronaire as a function of harvest day for well-opened and moderately opened bolls for cottons 1 and 2.

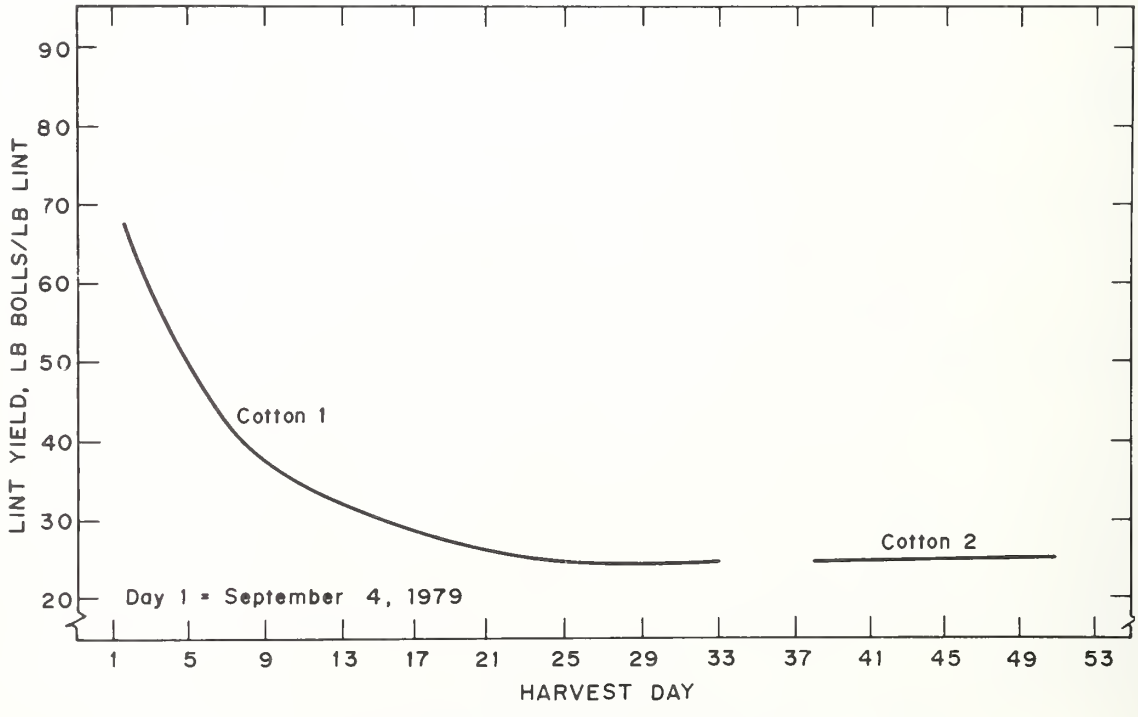


FIGURE 9.—Lint yield, in pounds of bolls per pound of lint, for cottons 1 and 2.

into three categories and subsequent discard of the unopened and poorly opened bolls produced yield ratios higher than 16 to 1. Figure 9 demonstrates the large quantity of bolls required early in the harvest period and the subsequent improvement as the period progressed. The best yield ratio was 19.3 pounds of bolls per pound of lint cotton on October 17. The weighted mean for the yield ratio in 1979 was 29.9 to 1. Data in table 2 suggest that 40 percent of the bolls were discarded; thus, if the weight of the discarded bolls were subtracted, the weighted mean for the yield ratio would be reduced to 18 pounds of bolls per pound of lint. These results suggest a definite need for improved accuracy in procedures for detection of closed-boll maturity. Table 10 contains the actual distribution of lint within specific micronaire ranges for cottons 1 and 2.

### Seed properties

Marketing properties and germination levels for cottons 1 and 2 are given in table 11 for individual batches. Substantial deviations occurred among batches for cottons 1 and 2. Free fatty acid content of the seed varied with the micronaire of the lint cotton (tables 3, 6, and 11). Seed from the high-micronaire cottons contained lower amounts of free fatty acids than those from the low-micronaire cottons. The oil content of the seed was directly proportional to the micronaire of the lint. The high-micronaire cotton generally had more mature seed than the low-micronaire cotton; thus, the seed had higher oil content.

Means and standard deviations for seed properties of cottons 1, 2, and 3 are given in table 12. The standard deviations for most of the seed properties endorse the division of the cotton into bales as a function of maturity.

### Cottons 4, 5, and 6

Fiber data for cottons 4, 5, and 6 are given in tables 13 and 14. These data adequately document the fiber properties and their differences among these cottons. The hand-harvested cotton (cotton 4) was the highest grade, Strict Middling, whereas cotton 5 was the lowest grade. Seed properties for cottons 4, 5, and 6 are given in table 15. No substantial differences existed among the seed properties.

## SUMMARY

In 1979, large quantities of cottons having various levels of contamination were precisely harvested, processed, and analyzed for use in future research on the respiratory disorder known as byssinosis.

The fiber properties of cottons hand-harvested in the closed-boll form and receiving no seed-cotton or lint cleaning (cotton 1), cottons hand-harvested in the closed-boll form and processed through a stick machine, an extractor feeder, and a lint cleaner (cotton 2), and cottons conventionally harvested and processed (cotton 3) were similar within harvesting treatments.

(*Continued on page 18.*)

**Table 10.—Bale weights and micronaire ranges for cottons 1 and 2**

| Cotton number | Bale number | Micronaire range | Batch numbers | Bale weight (lb) |
|---|---|---|---|---|
| 1 | 4022 | 2.50–2.99 | 1, 3, 4, 9, 13, 15, 20, 23, 25, 37, 51, 54 | 535 |
| | 4023 | 3.00–3.49 | 2, 10, 11, 18, 28, 29, 31, 33 | 337 |
| | 4024 | 3.00–3.49 | 35, 39, 41, 43, 47, 49, 53 | 365 |
| | 4025 | 3.50–4.50 | 6, 12, 14, 16, 17, 19, 21, 22, 24, 26, 27 | 462 |
| | 4026 | 3.50–4.50 | 30, 32, 34, 36, 38, 40, 42, 44 | 484 |
| | 4027 | 3.50–4.50 | 45, 46, 48, 50, 52, 55 | 488 |
| 2 | 4033 | 3.50–4.50 | 56, 58 | 477 |
| | 4034 | 3.50–4.50 | 60, 63 | 359 |
| | 4035 | 3.00–3.49 | 64, 68, 71 | 530 |
| | 4036 | 2.50–2.99 | 61, 65, 67, 72 | 407 |
| | 4037 | 2.50–2.99 | 57, 59, 70 | 444 |
| | 4038 | <2.30–2.49 | 62, 66, 69, 73, 74, 75 | 343 |

**Table 11.—Marketing properties and germination levels for cottons 1 and 2[1]**

| Batch number[2] | Analyses (pct) | | | | | Germination[3] | Quantity index | Grade index | Estimated yield (pct) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total foreign matter | Moisture | Free fatty acids | Oil | Ammonia | | | | Oil | Cake |
| 1 | 0.1 | 8.8 | 1.2 | 12.5 | 3.67 | 60.0 | 77.02 | 77.0 | 192 | 862 |
| 2 | .1 | 8.5 | 1.1 | 14.8 | 3.80 | 66.0 | 87.00 | 87.0 | 237 | 893 |
| 3 | .1 | 8.6 | 1.2 | 14.3 | 3.65 | 58.0 | 84.10 | 84.0 | 228 | 858 |
| 4 | .1 | 8.7 | 1.2 | 13.4 | 3.61 | 78.0 | 80.26 | 80.5 | 210 | 848 |
| 5 | .5 | 9.3 | 1.7 | 8.5 | 3.47 | 36.0 | 59.82 | 60.0 | 113 | 815 |
| 6 | .2 | 7.8 | .8 | 19.9 | 3.53 | 90.0 | 105.78 | 106.0 | 341 | 830 |
| 7 | .2 | 9.5 | 1.7 | 9.5 | 3.55 | 50.0 | 64.30 | 64.5 | 133 | 834 |
| 8 | .3 | 9.6 | 2.4 | 8.3 | 3.26 | 38.0 | 57.76 | 56.5 | 111 | 766 |
| 9 | .1 | 8.8 | 1.7 | 14.6 | 3.47 | 62.0 | 84.22 | 84.0 | 235 | 815 |
| 10 | .1 | 8.4 | 1.7 | 18.1 | 3.39 | 52.0 | 97.74 | 97.5 | 306 | 797 |
| 11 | .1 | 8.7 | .9 | 18.9 | 3.50 | 62.0 | 101.60 | 101.5 | 321 | 823 |
| 12 | .1 | 8.3 | .7 | 14.2 | 3.79 | 86.0 | 84.54 | 84.5 | 225 | 891 |
| 13 | .1 | 8.5 | 2.0 | 17.7 | 3.57 | 66.0 | 97.22 | 96.5 | 297 | 839 |
| 14 | .1 | 8.0 | .6 | 14.8 | 3.59 | 50.0 | 85.74 | 85.5 | 239 | 844 |
| 15 | .1 | 8.3 | .9 | 18.8 | 3.44 | 48.0 | 100.84 | 101.0 | 320 | 808 |
| 16 | .1 | 7.9 | .9 | 15.8 | 3.71 | 84.0 | 90.46 | 90.5 | 258 | 872 |
| 17 | .1 | 8.1 | .6 | 17.5 | 3.52 | 84.0 | 96.12 | 96.0 | 293 | 827 |
| 18 | .1 | 8.6 | 1.1 | 14.7 | 3.47 | 82.0 | 84.62 | 84.5 | 237 | 815 |
| 19 | .1 | 8.2 | .8 | 18.3 | 3.85 | 84.0 | 101.30 | 101.5 | 307 | 905 |
| 20 | .1 | 8.7 | .9 | 15.9 | 3.70 | 76.0 | 90.80 | 91.0 | 260 | 870 |
| 21 | .1 | 8.2 | .6 | 18.7 | 3.77 | 70.0 | 102.42 | 102.5 | 315 | 886 |
| 22 | .1 | 8.4 | .7 | 18.0 | 3.75 | 78.0 | 99.50 | 99.5 | 301 | 881 |
| 23 | .1 | 8.8 | .8 | 16.7 | 3.77 | 80.0 | 94.42 | 94.5 | 275 | 886 |
| 24 | .1 | 8.8 | .7 | 18.0 | 4.00 | 66.0 | 101.00 | 101.0 | 300 | 940 |
| 25 | .1 | 9.0 | .9 | 15.3 | 3.53 | 76.0 | 87.38 | 87.5 | 249 | 830 |
| 26 | .1 | 8.3 | .7 | 17.4 | 3.61 | 62.0 | 96.26 | 96.5 | 290 | 848 |
| 27 | .1 | 8.4 | .6 | 19.0 | 4.00 | 70.0 | 105.01 | 105.0 | 320 | 940 |
| 28 | .1 | 8.5 | .7 | 17.0 | 3.81 | 82.0 | 95.86 | 96.0 | 281 | 895 |
| 29 | .1 | 8.6 | .7 | 16.3 | 3.80 | 62.0 | 93.00 | 93.0 | 267 | 893 |
| 30 | .1 | 8.3 | .6 | 18.9 | 4.18 | 76.0 | 105.68 | 105.5 | 316 | 982 |
| 31 | .1 | 8.4 | .7 | 16.9 | 3.99 | 72.0 | 96.54 | 96.5 | 278 | 938 |
| 32 | .1 | 8.2 | .7 | 18.7 | 4.13 | 82.0 | 104.58 | 104.5 | 313 | 971 |
| 33 | .1 | 8.5 | .8 | 16.3 | 3.86 | 78.0 | 93.36 | 93.5 | 267 | 907 |
| 34 | .1 | 8.0 | .7 | 18.9 | 3.85 | 88.0 | 103.70 | 103.5 | 319 | 905 |
| 35 | .1 | 8.6 | .8 | 17.6 | 3.73 | 70.0 | 97.78 | 98.0 | 294 | 877 |
| 36 | .1 | 8.4 | .7 | 17.9 | 3.75 | 60.0 | 99.10 | 99.0 | 299 | 881 |
| 37 | .1 | 8.5 | .8 | 17.9 | 3.63 | 64.0 | 98.38 | 98.5 | 300 | 853 |
| 38 | .1 | 8.3 | .6 | 19.8 | 3.80 | 68.0 | 107.40 | 107.5 | 339 | 893 |
| 39 | .1 | 8.4 | .8 | 18.1 | 3.63 | 58.0 | 99.18 | 99.0 | 304 | 853 |
| 40 | .1 | 8.4 | .5 | 19.8 | 3.71 | 76.0 | 106.46 | 106.5 | 338 | 872 |
| 41 | .1 | 8.4 | .6 | 17.8 | 3.51 | 56.0 | 97.26 | 97.5 | 299 | 825 |
| 42 | .1 | 8.2 | .6 | 20.2 | 4.00 | 72.0 | 109.80 | 110.0 | 344 | 940 |
| 43 | .1 | 8.7 | .6 | 17.3 | 3.77 | 74.0 | 96.82 | 97.0 | 287 | 886 |
| 44 | .1 | 8.4 | .5 | 19.9 | 3.95 | 82.0 | 108.30 | 108.5 | 338 | 928 |
| 45 | .1 | 8.5 | .5 | 19.2 | 3.81 | 82.0 | 104.66 | 104.5 | 325 | 895 |
| 46 | .1 | 8.3 | .5 | 19.8 | 3.93 | 86.0 | 107.78 | 108.0 | 336 | 924 |
| 47 | .1 | 8.9 | .5 | 18.1 | 3.84 | 76.0 | 100.44 | 100.5 | 303 | 902 |
| 48 | .1 | 8.5 | .4 | 19.2 | 4.12 | 54.0 | 106.52 | 106.5 | 323 | 968 |
| 49 | .1 | 8.7 | .5 | 16.9 | 3.84 | 18.0 | 95.64 | 95.5 | 279 | 902 |
| 50 | .1 | 8.4 | .5 | 18.9 | 3.99 | 58.0 | 104.54 | 104.5 | 318 | 938 |
| 51 | .1 | 8.8 | .5 | 16.0 | 3.79 | 40.0 | 91.74 | 91.5 | 261 | 891 |
| 52 | .1 | 8.5 | .6 | 18.6 | 4.12 | 52.0 | 104.12 | 104.0 | 311 | 968 |
| 53 | .1 | 8.8 | .8 | 15.6 | 3.94 | 70.0 | 91.04 | 91.0 | 252 | 926 |

See footnotes at end of table.

**Table 11.—Marketing properties and germinations for cottons 1 and 2[1]—Continued**

| Batch number[2] | Analyses (pct) | | | | | Germination[3] | Quantity index | Grade index | Estimated yield (pct) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total foreign matter | Moisture | Free fatty acids | Oil | Ammonia | | | | Oil | Cake |
| 54 | 0.1 | 8.6 | 0.7 | 17.5 | 3.78 | 72.0 | 97.68 | 97.5 | 291 | 888 |
| 55 | .1 | 8.2 | .5 | 19.4 | 3.98 | 76.0 | 106.48 | 106.5 | 328 | 935 |
| 56 | .5 | 8.4 | .4 | 19.1 | 3.89 | 84.0 | 104.74 | 104.5 | 322 | 914 |
| 57 | .5 | 9.5 | .6 | 14.0 | 3.59 | 40.0 | 82.54 | 82.5 | 223 | 844 |
| 58 | 3.7 | 8.4 | .4 | 19.3 | 3.89 | 69.6 | 105.54 | 102.5 | 326 | 914 |
| 59 | .5 | 8.8 | 1.0 | 14.8 | 3.70 | 66.7 | 86.40 | 96.5 | 238 | 870 |
| 60 | .5 | 8.4 | .6 | 18.4 | 3.97 | 70.7 | 102.42 | 102.5 | 308 | 933 |
| 61 | .4 | 9.0 | .7 | 14.7 | 3.65 | 56.0 | 85.70 | 85.5 | 236 | 858 |
| 62 | .5 | 9.4 | .9 | 14.4 | 3.64 | 28.0 | 84.44 | 84.5 | 230 | 855 |
| 63 | .5 | 8.6 | .5 | 18.2 | 3.94 | 75.3 | 101.44 | 101.5 | 304 | 926 |
| 64 | .6 | 8.8 | .6 | 17.6 | 4.06 | 70.0 | 99.76 | 100.0 | 291 | 954 |
| 65 | .5 | 9.2 | .6 | 13.3 | 3.57 | 68.0 | 79.62 | 79.5 | 209 | 839 |
| 66 | .5 | 9.0 | .8 | 12.5 | 3.74 | 58.0 | 77.44 | 77.5 | 191 | 879 |
| 67 | .5 | 8.9 | .8 | 13.5 | 3.75 | 50.0 | 81.50 | 81.5 | 211 | 881 |
| 68 | .5 | 8.2 | .5 | 17.2 | 4.04 | 79.0 | 98.04 | 98.0 | 283 | 949 |
| 70 | .5 | 8.0 | 1.0 | 19.0 | 4.26 | 70.5 | 106.56 | 106.5 | 318 | 1001 |
| 71 | .5 | 8.0 | .6 | 19.3 | 4.10 | 74.4 | 106.80 | 107.0 | 325 | 964 |
| 72 | .5 | 7.9 | .7 | 19.0 | 4.15 | 69.6 | 105.90 | 106.0 | 319 | 975 |
| 73 | .5 | 8.5 | .9 | 11.6 | 3.91 | 64.4 | 74.86 | 75.0 | 172 | 919 |
| 74 | .5 | 8.7 | .5 | 13.1 | 3.86 | 54.7 | 80.56 | 80.5 | 203 | 907 |
| 75 | .5 | 8.9 | .6 | 12.2 | 3.84 | 61.5 | 76.84 | 77.0 | 185 | 902 |

[1]Cotton 1 included batches 1-55, and cotton 2 included batches 56-75. Quality index was 100.0 for all batches except 13 (99.2) and 57 (97.3).

[2]Sufficient data for batch 69 were not available.

[3]Germination is not used in marketing of seed for oil uses.

**Table 12.—Means and standard deviations for seed properties of cottons 1, 2, and 3**

| Cotton number | Statistic | Analyses (pct) | | | | | Quantity index | Quality index | Grade index | Estimated yield (lb) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Foreign matter | Free fatty acids | Oil | Ammonia | Germination | | | | Oil | Cake |
| 1 | Mean | 0.10 | 0.85 | 16.96 | 3.75 | 67.24 | 95.28 | 99.94 | 95.26 | 280.46 | 880.64 |
| | Standard deviation | .01 | .42 | 2.69 | .21 | 13.86 | 11.45 | .34 | 11.53 | 53.13 | 48.80 |
| 2 | Mean | .51 | .67 | 15.85 | 3.88 | 67.76 | 91.64 | 99.87 | 91.50 | 257.58 | 909.68 |
| | Standard deviation | .06 | .19 | 2.80 | .21 | 7.33 | 12.04 | .60 | 11.87 | 55.04 | 46.18 |
| 3 | Mean | .23 | 64 | 17.23 | 3.99 | 80.30 | 97.82 | 100.00 | 97.75 | 625.35 | 936.67 |
| | Standard deviation | .02 | .08 | .34 | .06 | 8.50 | 1.59 | .00 | 1.60 | 14.74 | 14.36 |

**Table 13.—Results of tests on cottons 4, 5, and 6 for fibrograph length and length uniformity, Pressley strength, micronaire fineness, AMS grade index, and classer's staple length**

| Cotton number | Bale number | Digital fibrograph | | | Pressley strength, 1/8-inch gage (g/tex) | Micronaire reading | AMS grade index[1] | | | Classer's staple length, (32d inch) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2.5-pct span length (inches) | 50-pct span length (inch) | Uniformity ratio (pct) | | | Color | Leaf | Composite | |
| 4 | 4028 | 1.18 | 0.53 | 44.9 | 25.2 | 4.2 | 21 | 21 | 21 | 36 |
| | 4029 | 1.18 | .53 | 44.9 | 25.2 | 4.2 | 21 | 21 | 21 | 36 |
| 5 | 4030 | 1.20 | .52 | 42.9 | 25.3 | 4.3 | 42 | 51 | 52 | 36 |
| | 4031 | 1.19 | .51 | 42.8 | 25.3 | 4.1 | 42 | 42 | 42 | 35 |
| 6 | 4048 | 1.11 | .46 | 41.2 | 23.5 | 3.5 | 41 | 41 | 41 | 35 |
| | 4049 | 1.10 | .44 | 40.4 | 23.8 | 3.5 | 41 | 41 | 41 | 35 |
| | 4050 | 1.11 | .45 | 40.6 | 23.3 | 3.5 | 41 | 41 | 41 | 34 |
| | 4051 | 1.12 | .45 | 40.4 | 23.8 | 3.5 | 41 | 41 | 41 | 34 |
| | 4052 | 1.12 | .45 | 40.2 | 23.0 | 3.5 | 41 | 41 | 41 | 35 |
| | 4053 | 1.11 | .45 | 40.2 | 23.8 | 3.7 | 41 | 41 | 41 | 34 |
| | 4054 | 1.12 | .45 | 40.4 | 24.1 | 3.5 | 41 | 41 | 41 | 35 |
| | 4055 | 1.14 | .45 | 40.0 | 23.2 | 3.3 | 41 | 41 | 41 | 35 |
| | 4056 | 1.12 | .45 | 39.0 | 23.7 | 3.4 | 41 | 41 | 41 | 34 |
| | 4057 | 1.13 | .44 | 38.8 | 23.1 | 3.3 | 41 | 41 | 41 | 34 |
| | 4058 | 1.11 | .44 | 39.8 | 22.8 | 3.3 | 41 | 41 | 41 | 34 |
| | 4059 | 1.11 | .44 | 40.0 | 23.3 | 3.5 | 41 | 41 | 41 | 34 |

[1]Agricultural Marketing Service (AMS) grades are defined as follows: 21=Strict Middling, 31=Middling, 40=Strict Low Middling Plus, 41=Strict Low Middling, 42=Strict Low Middling Light Spotted, 51=Low Middling, and 52=Low Middling Light Spotted.

**Table 14.—Bale weights and results of tests for sugar content, hydrocarbon oil contamination, and reflectance and yellowness of lint for cottons 4, 5, and 6**

| Cotton number | Bale number | Sugar content[1] | Hydrocarbon oil contamination[2] (pct) | Colorimeter code | | Bale weight[3] (lb) |
|---|---|---|---|---|---|---|
| | | | | $R_d$ | +$b$ | |
| 4 | 4028 | | 0.18 | 81.2 | 8.9 | 307 |
| | 4029 | | .18 | 81.2 | 8.9 | 289 |
| 5 | 4030 | + | .16 | 72.4 | 9.3 | 289 |
| | 4031 | + | .17 | 76.7 | 8.9 | 318 |
| 6 | 4048 | | .20 | 77.3 | 8.4 | 499 |
| | 4049 | | .23 | 77.4 | 8.4 | 497 |
| | 4050 | | .24 | 75.8 | 8.4 | 488 |
| | 4051 | | .21 | 77.1 | 8.4 | 484 |
| | 4052 | | .21 | 76.2 | 8.3 | 482 |
| | 4053 | | .18 | 76.3 | 8.1 | 491 |
| | 4054 | + | .17 | 77.4 | 8.2 | 439 |
| | 4055 | + | .17 | 77.8 | 8.5 | 564 |
| | 4056 | + | .19 | 76.3 | 8.5 | 484 |
| | 4057 | + | .18 | 76.9 | 8.3 | 473 |
| | 4058 | + | .18 | 77.1 | 8.5 | 488 |
| | 4059 | + | .17 | 77.2 | 8.4 | 494 |

[1]"+" indicates value greater than 0.35 pct, and " " indicates value less than 0.35 pct.

[2]Values less than 0.30 pct are considered normal, since the natural oils may account for that amount.

[3]Bales 4060, 4061, 4062, and 4063 weighed 483, 462, 462, and 471 lb, respectively.

**Table 15.—Marketing properties and germination levels for cottons 4, 5, and 6[1]**

| Cotton number | Bale number | Analyses (pct) | | | | | | Quantity index | Grade index | Estimated yield (lb) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total foreign matter | Moisture | Free fatty acids | Oil | Ammonia | Germination[2] | | | Oil | Cake |
| 4 | 4028 | 0.1 | 9.6 | 0.6 | 17.5 | 4.06 | 84.8 | 99.36 | 99.5 | 289 | 954 |
| 5 | 4030 | .2 | 10.6 | .8 | 17.9 | 4.01 | 76.0 | 100.66 | 100.5 | 298 | 942 |
| | 4031 | .2 | 10.2 | .8 | 18.1 | 4.07 | 74.0 | 101.82 | 102.0 | 301 | 956 |
| 6 | 4048 | .2 | 10.0 | .5 | 17.2 | 3.99 | 75.0 | 97.74 | 97.5 | 284 | 938 |
| | 4049 | .2 | 9.8 | .6 | 17.2 | 3.95 | 84.0 | 97.50 | 97.5 | 284 | 928 |
| | 4050 | .2 | 9.8 | .8 | 17.5 | 3.95 | 94.0 | 98.70 | 98.5 | 290 | 928 |
| | 4051 | .2 | 9.5 | .7 | 17.8 | 4.12 | 73.0 | 100.92 | 101.0 | 295 | 968 |
| | 4052 | .2 | 10.1 | .7 | 17.4 | 3.97 | 74.8 | 98.42 | 98.5 | 288 | 933 |
| | 4053 | .6 | 9.8 | .6 | 17.6 | 4.05 | 80.7 | 99.70 | 99.5 | 291 | 952 |
| | 4054 | .2 | 9.8 | .6 | 17.0 | 4.07 | 80.5 | 97.42 | 97.5 | 279 | 956 |
| | 4055 | .2 | 9.5 | .6 | 16.6 | 3.94 | 80.7 | 95.04 | 95.0 | 272 | 926 |
| | 4056 | .2 | 9.8 | .7 | 16.9 | 3.93 | 80.7 | 96.18 | 96.0 | 278 | 924 |
| | 4057 | .2 | 9.9 | .7 | 17.0 | 3.98 | 80.7 | 96.88 | 97.0 | 280 | 935 |
| | 4058 | .2 | 9.8 | .6 | 17.0 | 3.95 | 78.7 | 96.70 | 96.5 | 280 | 928 |
| | 4059 | .2 | 10.0 | .6 | 17.5 | 3.93 | 86.4 | 98.58 | 98.5 | 290 | 924 |

[1]Quality index was 100.0 for all bales.
[2]Germination is not used in marketing of seed for oil uses.

**Table 16.—Means and standard deviations for fiber properties of all cottons in study**

| Cotton number | Statistic | Digital fibrograph | | | Pressley strength, 1/8-inch gage (g/tex) | AMS grade index | | | Classer's staple length (32d inch) |
|---|---|---|---|---|---|---|---|---|---|
| | | 2.5-pct span length (inches) | 50-pct span length (inch) | Uniformity ratio (pct) | | Color | Leaf | Composite | |
| 1 | Mean | 1.20 | 0.53 | 43.80 | 25.90 | 11 | 11 | 11 | 35.5 |
| | Standard deviation | .02 | .03 | 2.00 | 1.00 | ... | ... | ... | .5 |
| 2 | Mean | 1.14 | .46 | 40.30 | 24.70 | 31 | 41 | 40 | 35.1 |
| | Standard deviation | .03 | .03 | 1.20 | .80 | ... | ... | ... | .9 |
| 3 | Mean | 1.14 | .47 | 41.20 | 24.00 | 31 | 41 | 40 | 35.0 |
| | Standard deviation | .01 | .01 | .23 | .24 | ... | ... | ... | .0 |
| 4 | Mean | 1.18 | .53 | 44.90 | 25.20 | 21 | 21 | 21 | 36.0 |
| | Standard deviation | .... | ... | ..... | ..... | ... | ... | ... | .... |
| 5 | Mean | 1.20 | .52 | 42.80 | 25.30 | 42 | [1]42/51 | [1]42 52 | 35.5 |
| | Standard deviation | .01 | .01 | .07 | ..... | ... | ..... | ..... | .7 |
| 6 | Mean | 1.12 | .45 | 40.10 | 23.40 | 41 | 41 | 41 | 34.4 |
| | Standard deviation | .01 | .01 | .66 | .40 | ... | ... | ... | .5 |

[1]Values for bales 4030 and 4031; see table 13.

Among treatments, however, some differences in properties existed; those of cotton 1 were distinctly different from those of cottons 2 and 3. Means and standard deviations for the fiber properties of all the cottons are given in table 16, which summarizes the basic differences among the cottons.

Analyses of the seed properties indicated differences in the percentages of total foreign matter, free fatty acids, oil, and ammonia and also in quantity index, grade index, and estimated yield.

Selected bales from all the treatments will be processed through the model cardroom at the Cotton Quality Research Station at Clemson to determine the respiratory response of volunteers to dust from these cottons.

## REFERENCES


Boehlecke, B.; Cocke, J.; Bragg, K.; Hancocke, J.; Petsonk, E.; Piccirillo, R.; and Merchant, J.
1981. Pulmonary function response to standard and closed boll harvested cotton. Chest 79(4): 775-815.

Griffin, A. C., Jr.; Hatcher, J. D.: and Cocke, J. B.
1977. Card-room dust levels and response of humans to raw cotton cleaned by the Shirley Analyser. Text. Res. J. 47(2): 129-131.

Jones, J. W.; Colwick, R. F.; Barker, G. L.; and McClendon, R. W.
1976. Optimum time for harvesting cotton: a new concept. Trans. ASAE 22(2): 291-296.

Perkins, H. H., Jr.
1981. Effects of washing on fiber properties, dust generation and processing quality of cotton. Text. Res. J. 51(3): 123-127.




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